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(74) Agents: GAMSTORP, Bengt et al.; Telefonaktiebolaget L M Ericsson, S-126 25 Stockholm (SE).

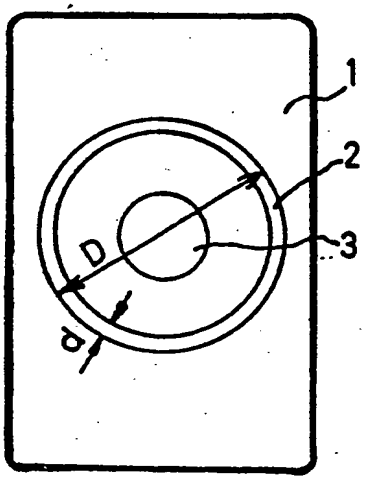
(81) Designated States: CH (European patent), DE (European patent), DK, FI, FR (European patent), GB (European patent), IT (European patent), JP, NL (European patent), NO, US.

Published
With international search report.

(54) Title: DATA REGISTRATION MEDIUM

(57) Abstract

A data registration medium for optical data storage comprises a rectangular card (1) preferably of the same kind as a credit card. The area where data is stored is an annular portion (2) with a width (d) which is much less than its diameter.



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DATA REGISTRATION MEDIUM

TECHNICAL FIELD

The invention relates to a data registration medium in the form of a rectangular card, preferably for optical data storage.

BACKGROUND ART

A generally used data storage medium has the form of a plastic card with the standardised format 53.975 x 85.598 mm. Data storage on cards of this kind known up to now has taken place with the aid of data-carrying strips, usually parallel to the longitudinal direction of the card. These strips may be of magnetic material, as with the generally prevailing charge, credit and bank cards. They may also comprise an optically active layer where data is stored in the form of portions which are either reflecting or non-reflecting. Reading is performed by a linear relative movement in the longitudinal direction of the card between it and a magnetic or optical reading head.

It is also known to store information optically on disks. Examples of such data storage systems are the so-called Compact Disk (CD) systems described in "Philips Technical Review", Vol 40, 1982, No 6, pp 151-155. The data carrier in this system is a disk where the signal is stored in the form of a spiral track comprising a series of depressions on the surface of the disc. The bottom of the depressions as well as intermediate surfaces are covered with a reflecting material. Reading is performed by a laser beam which is reflected by the surface of the disk and by the bottoms of the depressions. The laser beam follows the track with the aid of a simple servo mechanism which can shift the beam a minor distance radially. Moving the beam from the start of the track to its end takes place with the aid of a mechanism similar to the tone arm on an ordinary record player.

Since the laser unit used can project light on to a very small surface (in the order of magnitude 1 μm) there is enabled a very great packing densitity. The storage medium used in the CD system is usually programmed with digitally

recorded music, and the most usual technique for producing CD records is injection moulding transparent plastics in a mould where one defining surface contains the information as a surface relief. During the moulding process this is impressed on the disk surface, which is subsequently given a thin metallic coating. Reading is done through the transparent disk. Due to the interference phenomenon the reflected light will have different intensities depending on from what part of the relief it comes.

It is also known to make a storage medium of generally the same kind writable. In such a case holes can be burnt into the storage medium with the aid of focussed light from the laser, which is then driven at high power. A lesser light power not affecting the storage medium is used for reading the information. The same technique is most often used in manufacturing the storage medium as in the case above with permanent information, for providing fixed grooves that may be utilised for positioning and focussing the light spot. A thin layer is deposited over these grooves and the holes are burnt into it. Examples of this and further methods of optical data storage are to be found in "Vaccum Science and Technology", Vol 18, No 1, January/February 1981.

DISCLOSURE OF INVENTION

In many connections there is the need of a small, easily portable data medium containing a large amount of data. Examples of this are personal illness case histories, identity cards authorising the owner access to premises, data bases etc. A requirement is that the associated reader and, in the case where change in the information content shall be possible, the writing equipment shall be simple and cheap. It has bee found that a card of the standardised credit card format is ideal as a data carrier in respect of its format. With the strip-like data carrying areas of optical or magnetic type used for the data carrying cards described above, the reading means used for them will be complicated, particularly if the information is tightly packed.

Due to their round shape the disks used for optical storage of sound (the CD disks) and video signals and as data carriers are not accepted as an easily portable data medium. Furthermore, they are intended for very large amount of data, and the reading and writing equipment must be provided with mechanical means for radially scanning the disk.

It has been been found that for most purposes it is satisfactory with an information quantity of < 2 Mbytes. In accordance witht the invention, it is possible in such case to use a preferably rectangular card provided with an area intended for optical registration of data in the form of markings modifying the properties of the reflected light from a light beam incident on the area. The invention is distinguished by this area being formed as a annular ring, width of which is much less than its diameter. With the optical storage technique now available, about 2 Mbytes of information may be stored using a ring width of about 0.3 mm and a diameter of about 50 mm on the approximately 150 tracks for which there is room on this width.

BRIEF DESCRIPTION OF DRAWING

The invention will now be described in detail in connection with the appended Figures, where Figures 1 and 2 each illustrate an embodiment of a data carrier, Figure 3 is a cross section through a known carrier and Figure 4 schematically illustrates a reading and/or writing means.

BEST MODE FOR CARRYING OUT THE INVENTION

The data carrier illustrated in Figure 1 consists of a plastic card, suitably of the ISO standard format of approximately 54 x 86 mm. In the card surface there is a narrow annular information-carrying area 2. This area accommodates such as a spiral groove for example of the kind described in the above-mentioned article in "Philips Technical Review", but is intended for writing. The groove is schematically illustrated in Figure 3 in sectioned perspective, and comprises a transparent base material 5 that has been provided with a relief pattern with impressions 6. The entire relief pattern is covered by a thin layer 7 in which information may be stored witht the aid of a sufficiently powerful laser beam, which is incident on the layer 7 through the transparent layer. Where the laser light is incident on the layer 7 there is a change in the optical properties of this layer, e.g. by a hole being burnt into it. Reading is performed with the same laser but then at a power which is so low that the properties of the layer are not affected. The reflected light is detected and gives rise to a signal varying as the state of the surface and representing the stored information. A junction between an illuminated and non-illuminated surface during writing, and vice

versa, can be interpreted as a binary One while unchanged surface condition denotes Zero.

The groove suitably has the dimension standard for digital CD records, namely a groove pitch of 1.6 μm. With an information bit area of 1-2 μmm^2 a data quantity of about 2 Mbytes may be stored on the approximately 150 grooves accommodated on a ring width of 0.3 mm.

In the card of Figure 1 a hole 3 is disposed at the centre of the annular area 2. This hole of a diameter as 15 mm fits the rotating spindle of a drive means taking the information groove past a fixed read and/or write station, as illustrated in Figure 4. The groove 2 and hole 3 have their centres at the centre of gravity of the card. It is of course possible to place the groove displaced from this position, as is illustrated in Figure 2. In this embodiment the card is not provided with any centering hole and is intended to coact with a rotating drive means equiped with a holder retaining the card such that the centre of the annular portion 2 coincides with the centre of rotation.

It is schematically illustrated in Figure 4 how a data carrier in accordance with the invention coacts with a reading and writing unit. The card 1 is placed on a spindle 10 fitting the hole 3 in the card. The spindle is driven by a motor 11 controlled by a processor unit 12. The light for writing and reading is generated by a laser 13 with associated optics, and passes a semitransparent mirror 14, or alternatively a polarisation prisma, and further an objective unit 15, which refracts the pencil of rays to a light spot somewhat greater than the width of the depressions. The objective unit contains means for adjusting the focus and also shifting the light beam transverse the grooves. Such means are known per se, and are described, e.g. in the "Philips Technical Review" article mentioned above. The adjusting means of the objective unit are controlled by the servo unit 21 for focussing and by the unit 22 for adjusting the beam radially as well as tracking the groove from start to finish.

The light reflected from the card surface is guided by the mirror 14 to a detector unit 16, where the light beam is conventionally caused to be incident on a plurality of photosensors, the output signals of which, after certain processing, give three signals. The first is a digital signal 18 representing the

stored information. The second is a voltage signal 19 for keeping the beam on track in the groove and which controls the position servo 22. The third is a focussing signal used to adjust the laser beam focus so that the light spot is always positioned on the card surface, irrespective of any warping, and it controls the focussing servo 21.

The position signal is fed to the processor 12, which after further signal processing controls the drive motor 11 and also feeds a data signal to the output 23. The funtion of the reading and writing unit may be controlled from an input 24 on the processor 12. For writing, a writing signal is fed to the input 24. Each time an information bit is to be burnt the power of the laser 13 is increased. The latter has low power between the information bits and is then utilised for tracking the groove. During the reading process the laser is operated at low power the whole time.

The invention is not restricted to the described embodiments, and may be varied in a large number of ways within the scope of the inventive concept. The data registration does not need to take place in the way exemplified in Figure 3. In most applications it is indeed desirable that the card may be supplied with data during use, but in certain cases it may be supplied with permanent information, e.g. in the way used in the production of CD records.

Furthermore, a large number of other methods are known which enable writing information optically with great density. Some examples of such known methods which may be applied in connection with the invention use ablation (e.g. burning holes), change of shape (bubbles), phase change (recrystallisation), structure change (surface pattern), Photochromics (colour change) and interference (the two wavelength method). A storage medium of this kind may be manufactured empty of information or already partly programmed. To obtain easy tracking, such media are provided with fixed grooves in an extra layer or directly in the substrate as described above. Over this the storage medium is deposited as a thin layer. Writing is done as described above with the aid of a laser, which may be the same as is used for reading but driven at a substantially increased power, so that the desired changes arise in the layer.

It is also possible to provide a data registration medium in accordance with the invention with an area of a material which may be written on or erased optically. Examples of this are reversible phase conversions and magnetoptic storage.

It is also possible to apply several annular areas 2 concentrically. These different areas may then contain different kinds of information and be read in reading units having several radially displaceable reading heads or having separate readers for each area.

CLAIMS

1. Data carrier having the shape of a preferably rectangular card (1) provided with a circular area for packed optical recording of data in the form of markings modyfying the properties of the light from a light beam incident on the area in a known manner and where the reading and/or the recording is adapted to take place during the rotation of the card by means of at least one optical transducer head known per se and including a track holding mechanism for adjusting the beam position radially, characterized in that said annual area is shaped as at least one annular ring (2) the width (d) of which is less than the deflection range of said track holding mechanism.

2. Data carrier as claimed in claim 2, characterized in that the width of the annular area (2) is less than 2 mm.

3. Data carrier as claimed in claim 3, characterized in that the width of the annular area (2) is at most 0.3 mm.

4. Data carrier as claimed in claim 1, characterized in that the centre of the annular area is at the centre of gravity of the card (1).

5. Data carrier as claimed in claim 1, characterized in that the annular area (2) is unsymmetrically placed on the card (1).

6. Data carrier as claimed in claim 1, characterized by a hole at the centre of the annular area, and suited to a rotating spindle (10) on a reading and/or writing means intended for use in coaction with the card.

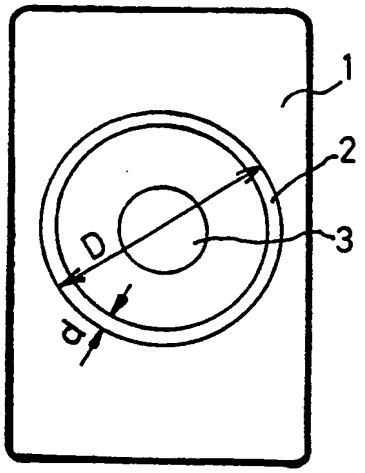

Fig.1

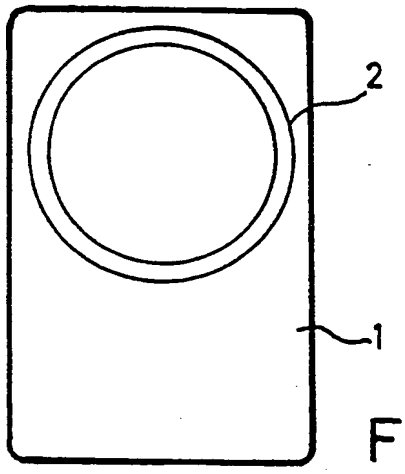

Fig.2

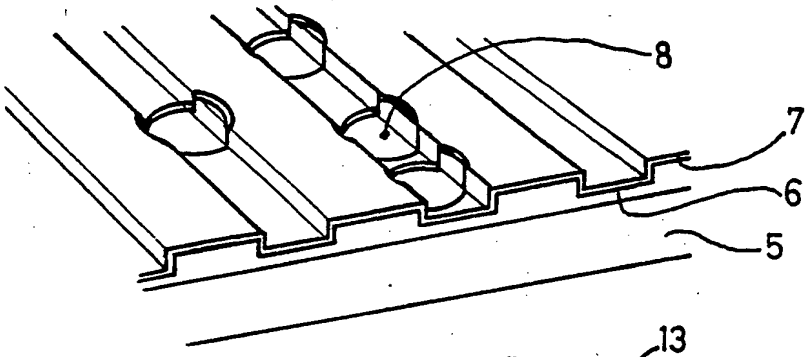

Fig.3

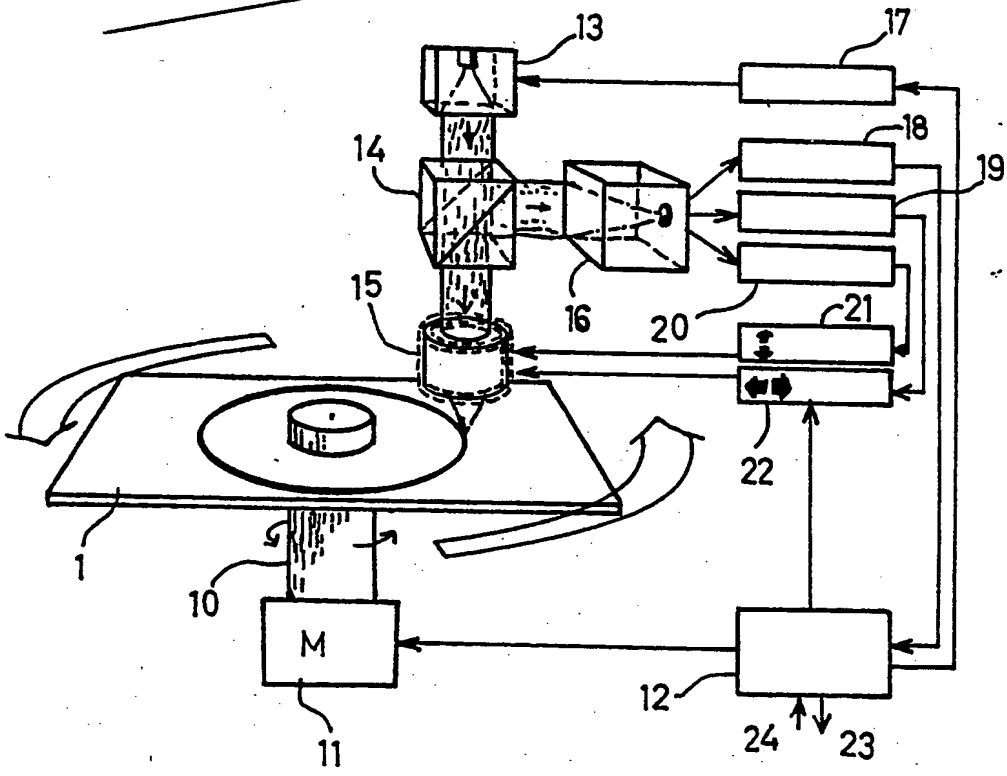

Fig.4

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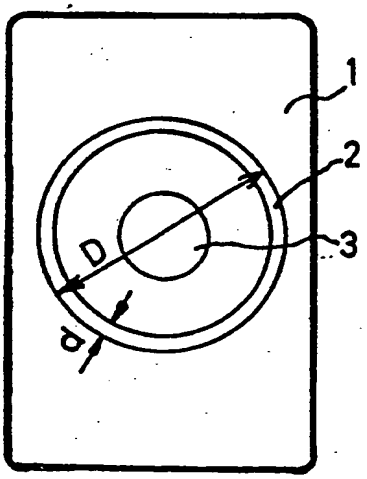

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It has been been found that for most purposes it is satisfactory with an information quantity of < 2 Mbytes. In accordance witht the invention, it is possible in such case to use a preferably rectangular card provided with an area intended for optical registration of data in the form of markings modifying the properties of the reflected light from a light beam incident on the area. The invention is distinguished by this area being formed as a annular ring, width of which is much less than its diameter. With the optical storage technique now available, about 2 Mbytes of information may be stored using a ring width of about 0.3 mm and a diameter of about 50 mm on the approximately 150 tracks for which there is room on this width.

BRIEF DESCRIPTION OF DRAWING

The invention will now be described in detail in connection with the appended Figures, where Figures 1 and 2 each illustrate an embodiment of a data carrier, Figure 3 is a cross section through a known carrier and Figure 4 schematically illustrates a reading and/or writing means.

BEST MODE FOR CARRYING OUT THE INVENTION

The data carrier illustrated in Figure 1 consists of a plastic card, suitably of the ISO standard format of approximately 54 x 86 mm. In the card surface there is a narrow annular information-carrying area 2. This area accommodates such as a spiral groove for example of the kind described in the above-mentioned article in "Philips Technical Review", but is intended for writing. The groove is schematically illustrated in Figure 3 in sectioned perspective, and comprises a transparent base material 5 that has been provided with a relief pattern with impressions 6. The entire relief pattern is covered by a thin layer 7 in which information may be stored witht the aid of a sufficiently powerful laser beam, which is incident on the layer 7 through the transparent layer. Where the laser light is incident on the layer 7 there is a change in the optical properties of this layer, e.g. by a hole being burnt into it. Reading is performed with the same laser but then at a power which is so low that the properties of the layer are not affected. The reflected light is detected and gives rise to a signal varying as the state of the surface and representing the stored information. A junction between an illuminated and non-illuminated surface during writing, and vice

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The groove suitably has the dimension standard for digital CD records, namely a groove pitch of 1.6 μm. With an information bit area of 1-2 μmm^2 a data quantity of about 2 Mbytes may be stored on the approximately 150 grooves accommodated on a ring width of 0.3 mm.

In the card of Figure 1 a hole 3 is disposed at the centre of the annular area 2. This hole of a diameter as 15 mm fits the rotating spindle of a drive means taking the information groove past a fixed read and/or write station, as illustrated in Figure 4. The groove 2 and hole 3 have their centres at the centre of gravity of the card. It is of course possible to place the groove displaced from this position, as is illustrated in Figure 2. In this embodiment the card is not provided with any centering hole and is intended to coact with a rotating drive means equiped with a holder retaining the card such that the centre of the annular portion 2 coincides with the centre of rotation.

It is schematically illustrated in Figure 4 how a data carrier in accordance with the invention coacts with a reading and writing unit. The card 1 is placed on a spindle 10 fitting the hole 3 in the card. The spindle is driven by a motor 11 controlled by a processor unit 12. The light for writing and reading is generated by a laser 13 with associated optics, and passes a semitransparent mirror 14, or alternatively a polarisation prisma, and further an objective unit 15, which refracts the pencil of rays to a light spot somewhat greater than the width of the depressions. The objective unit contains means for adjusting the focus and also shifting the light beam transverse the grooves. Such means are known per se, and are described, e.g. in the "Philips Technical Review" article mentioned above. The adjusting means of the objective unit are controlled by the servo unit 21 for focussing and by the unit 22 for adjusting the beam radially as well as tracking the groove from start to finish.

The light reflected from the card surface is guided by the mirror 14 to a detector unit 16, where the light beam is conventionally caused to be incident on a plurality of photosensors, the output signals of which, after certain processing, give three signals. The first is a digital signal 18 representing the

stored information. The second is a voltage signal 19 for keeping the beam on track in the groove and which controls the position servo 22. The third is a focussing signal used to adjust the laser beam focus so that the light spot is always positioned on the card surface, irrespective of any warping, and it controls the focussing servo 21.

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It is also possible to provide a data registration medium in accordance with the invention with an area of a material which may be written on or erased optically. Examples of this are reversible phase conversions and magnetoptic storage.

It is also possible to apply several annular areas 2 concentrically. These different areas may then contain different kinds of information and be read in reading units having several radially displaceable reading heads or having separate readers for each area.

CLAIMS

1. Data carrier having the shape of a preferably rectangular card (1) provided with a circular area for packed optical recording of data in the form of markings modyfying the properties of the light from a light beam incident on the area in a known manner and where the reading and/or the recording is adapted to take place during the rotation of the card by means of at least one optical transducer head known per se and including a track holding mechanism for adjusting the beam position radially, characterized in that said annual area is shaped as at least one annular ring (2) the width (d) of which is less than the deflection range of said track holding mechanism.

2. Data carrier as claimed in claim 2, characterized in that the width of the annular area (2) is less than 2 mm.

3. Data carrier as claimed in claim 3, characterized in that the width of the annular area (2) is at most 0.3 mm.

4. Data carrier as claimed in claim 1, characterized in that the centre of the annular area is at the centre of gravity of the card (1).

5. Data carrier as claimed in claim 1, characterized in that the annular area (2) is unsymmetrically placed on the card (1).

6. Data carrier as claimed in claim 1, characterized by a hole at the centre of the annular area, and suited to a rotating spindle (10) on a reading and/or writing means intended for use in coaction with the card.

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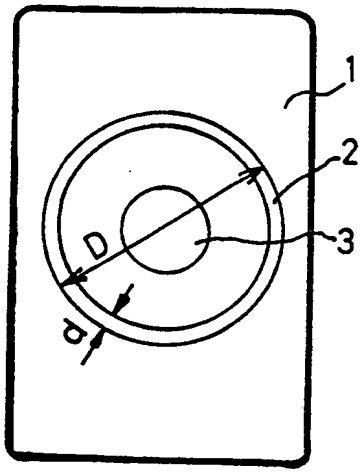

Fig.1

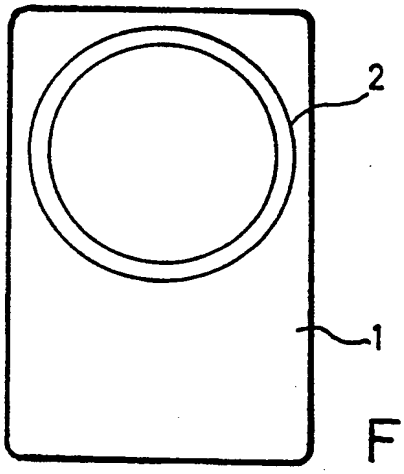

Fig.2

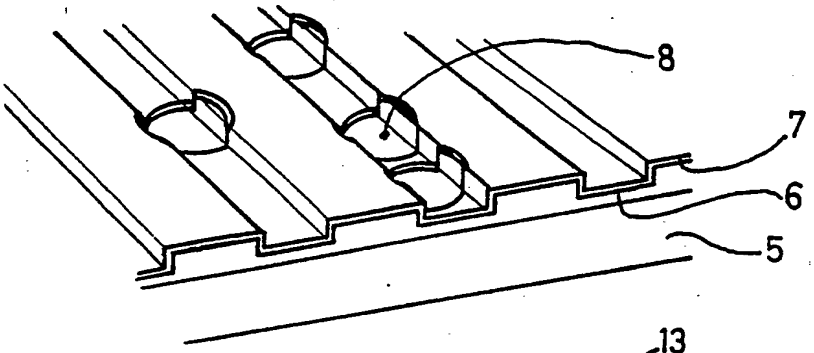

Fig.3

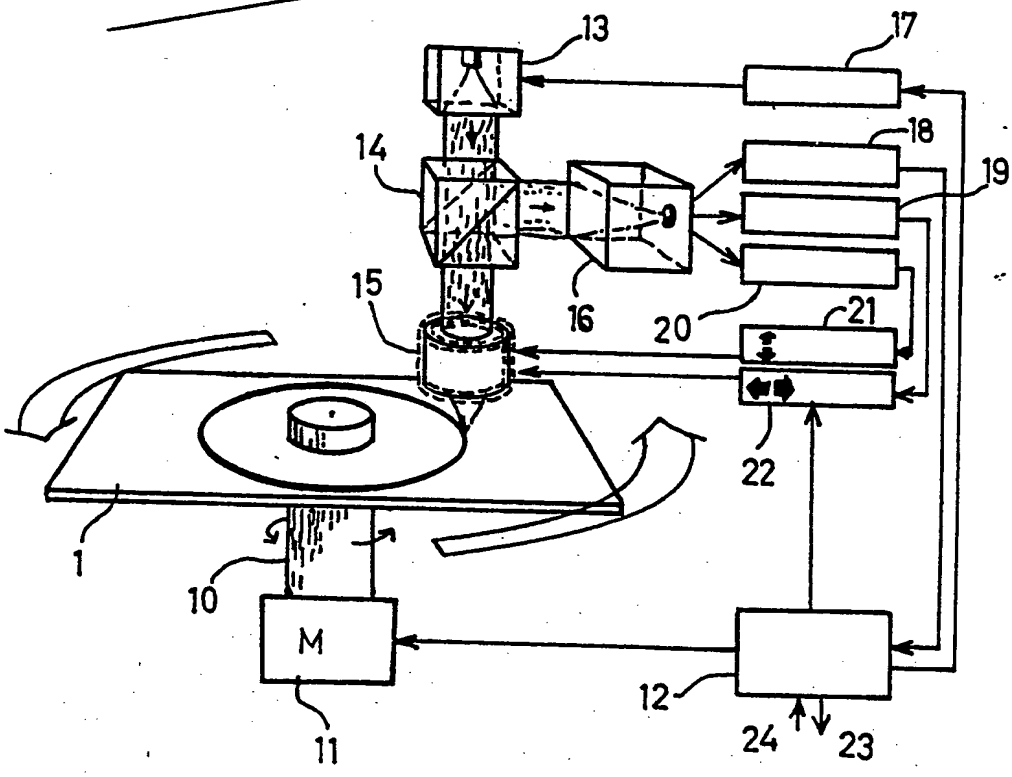

Fig.4

'ERNATIONAL SEARCH REPORT

International Application No PCT/SE86/00119

I. CLASSI MATTER (if several classification symbols apply, indicate all) *

According to cation (IPC) or to both National Classification and IPC 4

G 11 B

II. FIELDS

Minimum Documentation Searched 7

Classification	Classification Symbols
IPC 4	/00-/013, /24-/26; G 06 K 19/00, /04-/06; 1/00
US Cl	235:61.12, 487; 340:149A; 369:93-98, 275

mentation Searched other than Minimum Documentation
xtent that such Documents are included in the Fields Searched *

SE classes as above

III. DOCUME BE RELEVANT *

Category *	with indication, where appropriate, of the relevant passages 12	Relevant to Claim No. 13
A	US, 760 (P.H. HAMISCH) mber 1968	
A	DE, 821 (THE BENDIX CORP.) ober 1976	
A	DE, 176 (NV PHILIPS GLOEILAMPEN-KEN) ber 1980	

* Special categories: 10

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"&" document member of the same patent family

IV. CERTIFICATIO

Date of the Actual Co rnational Search	Date of Mailing of this International Search Report
1986-06-02	1986 -06- 09
International Searching Swedish Patce	Signature of Authorized Officer Fredrik Askerberg Fredrik Askerberg

Form PCT/ISA/210 (secon 1985)

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